Jameco Part number 136611

Printed Circuit Board Design Kit

This kit allows you to make a printed circuit board (PCB) using a photographic technique. With this technique the artwork containing your design can be reused, allowing you to make several identical circuit boards from the same artwork. Special equipment such as a 'darkroom' is not required and the process can be carried out under normal lighting conditions.

The supplied circuit board is pre-coated with a light sensitive film which is ***positive acting.*** This means that those parts of the coating which are exposed to light will be removed by the developing process, whereas those parts not exposed will remain. To protect the coating from light during storage, it is covered with an adhesive opaque plastic sheet.

In addition to this kit you will need some or all of the following equipment and supplies. Please read through all the instructions before you start making your PCB so that you will be fully prepared.

Additional equipment needed:

- Sheet of graph paper having a 0.1 inch grid
- Pencil and eraser
- Drafting film or a blank overhead projector transparency for preparing artwork
- Fine bladed 24TPI hack saw for cutting board to size
- Rubber gloves for use when handling developer and etchant
- Measuring container for measuring water
- Plastic trays for developing and etching
- Glass sheet and backing board for exposing board to light
- A 10 Watt or 15 Watt ordinary fluorescent desk light
- Etch resistant pen for repairing small defects before etching
- Ferric chloride or ammonium persulphate for etching the board
- Protective lacquer for protecting the final board from corrosion

Instructions for making a printed circuit board.

1. **Prepare your artwork.**

   Your artwork will be in the form of an opaque pattern on a clear background. The opaque pattern represents the copper pattern that will remain on the finished circuit board.

   Included in the kit are various size donuts and tapes which can be used to produce professional looking artwork. The donuts and tapes are placed onto a thin transparent film, such as drafting film or a blank overhead projector transparency, using the supplied knife. To accurately position the donuts and tapes, the design is initially pencilled onto graph paper having a 0.1" grid. The graph paper is placed under the film to act as a placement guide.

   An alternative method of generating artwork, if you have a computer, laser printer and suitable software, is to print the design directly onto tracing paper. This can produce excellent results however you need to make sure that your laser printer can handle tracing paper. When you print the pattern make sure the orientation is such that the printed (loner) side of the paper will be in contact with the light sensitive coating of the board when it is exposed.

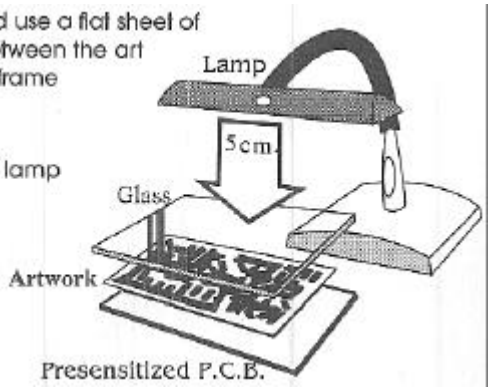
2. **Exposure.**

   a. If necessary cut the pre-coated circuit board to size using a fine bladed 24 TPI hack saw. Take care not to crack the board by bending it.

   b. Peel off the protective plastic layer covering the board. Darkroom conditions are not required but keep the board away from direct sunlight and strong lights.

   c. Place the completed artwork on top of the coated board and use a flat sheet of glass as a top layer to ensure a good contact (ie. no gaps) between the art work and the light sensitive coating on the board. A glass picture frame can be used or you may decide to make a custom frame especially for this purpose.

   d. Place the 'sandwich' under a 10 or 15 watt fluorescent desk lamp with the lamp 5 cm above the glass. Switch the lamp on for 10 minutes. This time is not exact and may need to be varied depending on the strength of the light. If the artwork is laser printed onto tracing paper the time needed will be closer to 15 minutes.



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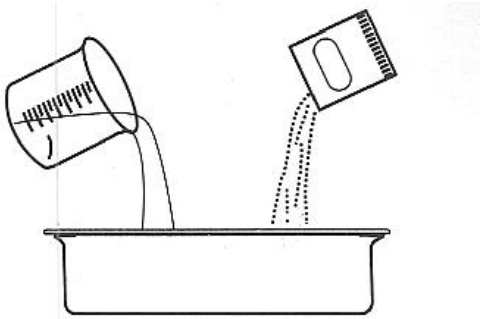
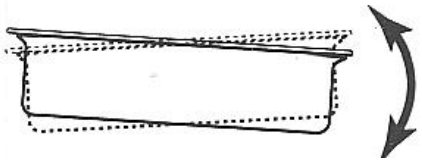
3. Developing



a. Prepare the developing solution by dissolving the developer in water in the ratio of 1 pack (50 grams) to 1 litre (1000 c.c.) of water. The ratio is not critical and a tolerance of - 10% to +30% is acceptable. Agitate until all the powder is dissolved.
Make up only as much developer as you need, for example if you are developing the smaller 79 mm x 50mm PCB, mix 1/3 of the developer with approximately 330 mL of water.

b. Immerse the exposed board in the developer and agitate until the image is clear, consisting of a dark green pattern on bare copper. This will typically take between 30 seconds and 2 minutes.

c. Remove the board from the developing solution and rinse under running water to remove the developer and stop the developing process. Save the developer for use after the board has been etched.



4. Inspection

a. Examine the board to see if it is a good reproduction of the original artwork - the coating should have remained where the artwork was opaque and bare shiny copper should be visible where the artwork was clear. Minor corrections can be made using the techniques outlined below:

- If the board is not fully developed it can be briefly returned to the developer to complete the process, provided that the examination did not expose the board to strong light for more than a minute or so.
- If the board is fully developed but has a few small spots of coating where the copper should be bare, use the knife to carefully scrape away the unwanted sections.
- Small breaks in the circuit pattern or coating can be repaired with an etch resistant pen.

5. Etching

a. You can use either ferric chloride or ammonium persulphate to etch away the bare copper on the board. Follow the instructions included with the etchant to prepare enough solution to etch the board.

b. Place the board in the solution, pattern side up, and agitate until the bare copper is removed leaving only the pattern.

c. Remove the board and rinse thoroughly under running water.

6. Removing the coating from the copper pattern.

a. Expose the etched PCB under the desk light or sunlight for 10 minutes.

b. Immerse the board in the used developer from step 3c. and agitate until the coating is removed, leaving the copper pattern.

c. Rinse the board under running water and allow to dry.

- Alternatively you can remove the coating using methylated spirits.

7. Finishing up

a. Dispose of used developer and etchant sensibly. Ferric chloride may be kept and reused.

b. Drill the required holes in the PCB.

c. Coat the finished circuit board with a protective solder-through lacquer to protect it from corrosion.